

A Survey of Acari Species and the found Prevalence of Medically Relevant *Ixodes* sp. in College Station, Texas

Brittany Gutierrez, Alyssa Henderson, Austin Hurst, Kade Keener, Christina Larrosa, Nick Richter, Eric Smith, Audrey Stedman

Edited by Taylor Chapman

Abstract: Within the Acari species, there are a number of specimens known to spread diseases of medical importance. Of the two most common tick spread diseases found in Texas, Lyme disease and Rocky Mountain Spotted Fever, Lyme disease, caused by *Borrelia burgdorferi*, has a higher number of incidents and therefore is the focus of the survey. This disease is known to have detrimental effects upon the nervous system and heart in humans. Two species are known for being prominent vectors of Lyme disease, *Ixodes scapularis* and *Ixodes pacificus*. Of these two ticks, *I. scapularis* is a common tick found in Texas and is primary tick to identify. A survey of ticks obtained from local animal shelters was performed and 29 species were identified. *I. scapularis* had the highest rate of identification. Due to the high amounts of *I. scapularis* in the survey, actions can be taken by the community to prevent future outbreaks of Lyme Disease in the College Station and Bryan areas.

Keywords: Ticks, Lyme disease, Ixodes scapularis, disease, vector, survey

According to the Center for Disease Control and Prevention (CDC) Lyme disease, which is caused by a bacterial infection due to the organism *Borrelia burgdorferi*, is known to be the most frequently reported arthropod-borne disease in the United States. *B. burgdorferi* moves to the infected ticks' mouthparts and is transmitted during feeding (Piesman 1993). For better understanding of the spread of the pathogen in the United

States, it is imperative to study two prevalent species in the *Ixodes* genus. The genus is characterized by pronounced sexual dimorphism, an inornate scutum, and a varying palpi/basis capitula (Thevanayagam 2012). In Texas, there are four common tick types. These are *Rhipicephalus sanguineus*, *Dermacentor variabilis*, *Amblyomma americanum*, and *Ixodes scapularis* (Downer 2017). These ticks carry a variety

of diseases with the most common being Lyme disease and Rocky Mountain Spotted Fever (Downer 2017). While there are more species capable of transmitting these pathogens, the black legged deer tick, (*Ixodes scapularis*), “spreads the disease in the northeastern, mid-Atlantic, and north-central United States, and the western blacklegged tick (*Ixodes pacificus*) spreads the disease on the Pacific Coast” (CDC Lyme Disease). Lyme disease, being the disease with the higher number of incidents in Texas, will be the primary focus and therefore the key vector to look for is *I. scapularis*. Knowing that Lyme Disease is often spread by nymphs in these two species, preventative measures can be taken during before and during the spring and summer months when they are most likely to feed (CDC Lyme Disease).

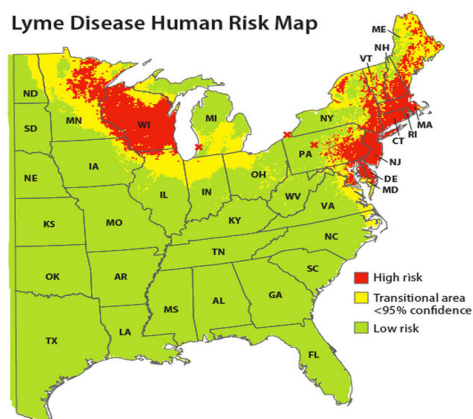


Figure 1. Map of risk areas for Lyme disease, vectored by *Ixodes scapularis*.

In September 1998, the *Journal of Medical Entomology* attempted to construct a “national map of the distribution of the vectors of *B. burgdorferi* to humans.” The study involved the participation of acarologists, Lyme disease researchers, and health professionals in order to collect “a total of 1,058 unique, county-specific *I. scapularis* and *I. pacificus* records” detailing the vectors distribution across the United States. The methods used to collect the specimens described in the study vary from “flagging and dragging, deer surveys, small- and medium-sized mammal surveys, CO2 baiting, and receipt of tick submissions.” Using the collected data, it was found that there were 392 established populations of the species *I. scapularis* across the northeastern, eastern, and central United states. In contrast, *I. pacificus* was found to only be established in 90 counties ranging across 5 states in western North America (Dennis 1998). While there were reports, of medically relevant *Ixodes* sp. in southern states, the populations were found to be statistically insignificant to that of their North Eastern and Western Coastal counterparts. Establishing a map of vector distribution is imperative when identifying regions of higher risk, developing prevention strategies, distributing

information regarding vector avoidance, and monitoring growing trends in spatial distribution of Lyme disease vector ticks (Dennis 1998).

This survey is to discern the prevalence of *I. scapularis* in the tick population in College Station and Bryan. In previous studies, the infection rate of *B. burgdorferi* was 18.5% of all the nymphs of *I. scapularis* that were caught and tested (Feldman 2015). Given these rates of infection and the amount of *I. scapularis* identified, the prevalence of Lyme disease in the community of College Station and surrounding areas can be estimated. By identifying higher quantities of *I. scapularis* and *I. pacificus* over other species of the genus *Ixodes*, actions can be taken to preventing the spread of diseases most connected with the two species.

Materials and Methods

Ticks were acquired by calling nearby animal hospitals and animal shelters. The specimens were collected from the local humane society. These ticks were removed from local pets, a majority being cats and dogs, in the College Station and Bryan area. The ticks were handled using fine-tipped tweezers (TickEase, Needham, MA) by students wearing gloves (FischerSci, Pittsburg, PA). Ticks are then placed in cuvettes (BioQuip, Compton, CA) with

ethanol for viewing and identification. Ticks were identified using a compound microscope and a tick identification key and pictorial chart, such as the Tick Id website provided by the CDC, or the Medical Entomology (ENTO 423) Laboratory Manual. These ticks can then be identified and sorted into two groups of the two known Lyme disease vectors, *I. scapularis* and *I. pacificus*, and other species that are not known to carry Lyme disease.

Specimen Identification

A total of 29 specimen from College Station and Bryan were collected and identified. The Medical Entomology (ENTO 423) Laboratory Manual was used to identify the species (Fig 2).



Figure 2. Image of *Ixodes scapularis*, the main tick vectoring Lyme disease.

Results

After collecting the 29 specimens off the dogs and cats at the local animal shelter located in Bryan Tx, each specimen was identified in the lab under a compound microscope. These ticks were collected off these animals through the months of

February through April. Out of the 29 specimens collected, two were identified as *Amblyomma maculatum*, the Gulf Coast Tick, two were identified as *Dermacentor variabilis*, the American Dog Tick, nine were identified as *Rhipicephalus sanguineus*, the Brown Dog Tick, and 16 were identified as *Ixodes scapularis*, the Blacklegged Tick (Fig. 3).

Lyme disease. This in particular is a public health threat to the College Station and

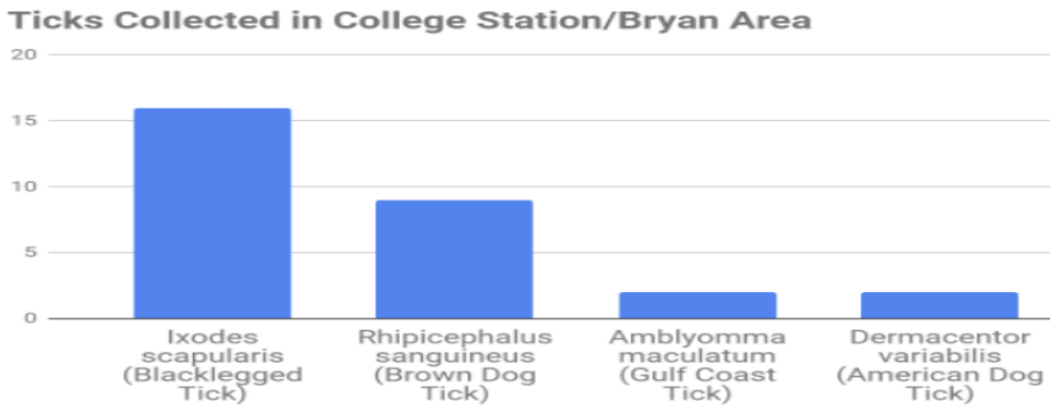


Figure 3. The number of species of ticks collected with *Ixodes scapularis* being the tick collected in the highest amount.

These results confirm that during the late winter season and the early spring season, the chances of being diagnosed with Lyme disease is moderate in the Bryan, College Station, Tx area and can be transmitted and contacted through the blacklegged tick.

Discussion

In College Station looking at the results from the data collected, we can see that the dominant species of ticks that was found was the species, *I. scapularis*. This specific species of tick has the capacity to vector

Bryan area, with 55.2% of the ticks that were recovered from the stray dogs and cats being *I. scapularis* (Figure 4).

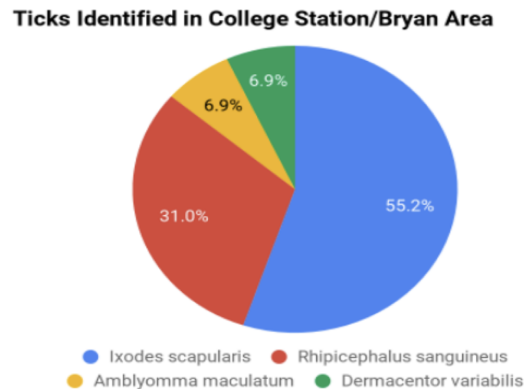


Figure 4. Relative percentages of collected ticks in the College Station and Bryan area identified on 4/16/2019.

It creates a major threat to the spread of the tick and more importantly the potential spread of Lyme disease to the public. Although Lyme disease is not typically lethal it often causes joint pain, fever, and rashes (Horowitz 2018). With more than 300,000 people in the United States alone yearly being diagnosed with Lyme disease the threat to public health is drastically increased when a particular demographic is exposed to a potential vector of lyme disease, such as the *I. scapularis* species in higher percentages (Johnson 2014). With the push away from kill free animal shelters, ensuring people that the animal they are getting doesn't have Lyme disease is huge. Bringing a new pet home to a new area or even family if still infected by ticks that carry Lyme Disease is contributing to the spread of the *I. scapularis* tick. With the data showing the ticks that were collected had been spread out all over the College Station and Bryan area, shows us that it is not just one localized area that is having a

tick problem with the *I. scapularis* species. This problem is mainly due to the fact that the animals that are being brought into the animal shelters have been stray animals. This makes it easier for the *I. scapularis* to attach to a dog or cat prior to the animal shelter. This doesn't just create a problem for the animal shelters and people, because the tick spreads Lyme disease, it is able spread it to other local animals such as cattle, deer, and horses. This makes it harder to track down and locate the exact places that need to be sprayed with acaricides. Diagnosing an animal with Lyme disease is hard to do because it takes a while for the dog to show symptoms after its been infected. When focusing on Lyme disease, looking at how it is transmitted from *I. scapularis* should be the first step in the prevention of the spread of the disease not only to the College Station/Bryan, TX area but around the nation.

References Cited

(CDC) Centers for Disease Control and Prevention. Lyme Disease: What You Need to Know.
<https://www.cdc.gov/Lyme/resources/brochure/Lymediseasebrochure.pdf>

(CDC) Center for Disease Control and Prevention. 2021. Lyme Disease.
<https://www.cdc.gov/lyme/index.html>

Dennis, D.T., Nekomoto T.S., Victor J.C., Paul W.S., Piesman J. 1998. Forum: Reported Distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the United States. *Journal of Medical Entomology*. 35(5):629-638.

Downer, R. 2017. Everything You Need to Know About Texas Ticks. Pest Control.
<https://www.abchomeandcommercial.com/blog/texas-ticks/>

Feldman K.A., Connally N.P., Hojgaard A., Jones E.H., White J.L., Hinckley A.F. 2015. Abundance and infection rates of *Ixodes scapularis* nymphs collected from residential properties in Lyme disease-endemic areas of Connecticut, Maryland, and New York. *J Vector Ecol*. 40(1):198-201.

Horowitz RI, Freeman PR. 2018. Precision Medicine: The Role of the MSIDS Model in Defining, Diagnosing, and Treating Chronic Lyme Disease/Post Treatment Lyme Disease Syndrome and Other Chronic Illness: Part 2. *Healthcare (Basel)*. 6(4):129.

Johnson L, Wilcox S, Mankoff J, Stricker RB. 2014. Severity of chronic Lyme disease compared to other chronic conditions. *PeerJ*. 2:322

Mike Merchant. 2016. Lyme Disease Ticks in Texas.
<https://citybugs.tamu.edu/2016/01/27/lyme-disease-ticks-in-texas/>

Piesman, J. 1993. Dynamics of *Borrelia burgdorferi* Transmission by Nymphal *Ixodes dammini* Ticks. *The Journal of Infectious Diseases*, 127(5):1082–1085.

Thevanayagam, S. 2012. "*Ixodes scapularis*" (On-line), Animal Diversity Web.
https://animaldiversity.org/accounts/Ixodes_scapularis/